

## Mars moon Phobos hip-deep in powder

By DIANE AINSWORTH

New temperature data and close-up images of the Martian moon Phobos gathered by JPL's Mars Global Surveyor indicate the surface of this small body has been pounded into powder by eons of meteoroid impacts, some of which started landslides that left dark trails marking the steep slopes of giant craters.

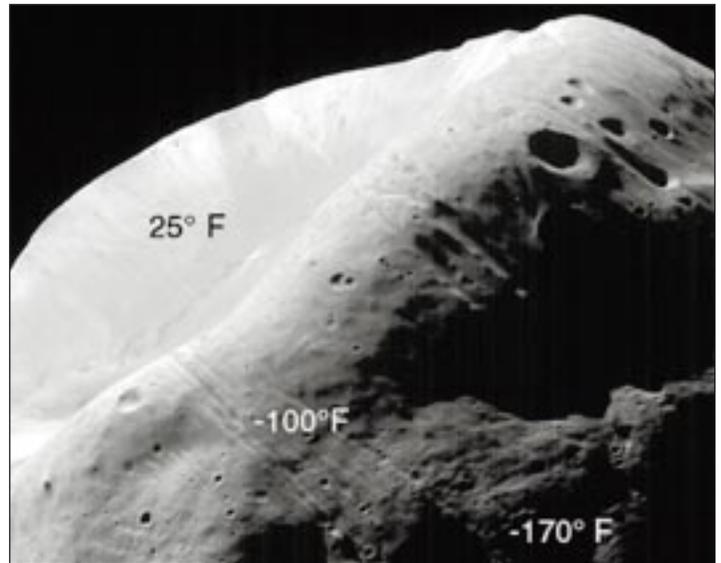
New temperature measurements show the surface must be composed largely of finely ground powder at least one meter (three feet) thick, according to scientists studying infrared data from the thermal emission spectrometer instrument on the spacecraft. Measurements of the day and night sides of Phobos show such extreme temperature variations that the sunlit side of the moon rivals a pleasant winter day in Chicago, while only a few kilometers away, on the dark side of the moon, the climate is more harsh than a night in Antarctica. High temperatures for Phobos were measured at minus 4 degrees Celsius (25 degrees F) and lows at minus 112 Celsius (minus 170 degrees F).

The extremely fast heat loss from day to night as Phobos turns in its seven-hour rotation can be explained if hip-deep dust covers its surface, said Dr. Philip Christensen of Arizona State University, principal investigator for the experiment on Global Surveyor.

"The infrared data tells us that Phobos, which does not have an atmosphere to hold heat in during the night, probably has a surface composed of very small particles that lose their heat rapidly once the Sun has set," Christensen said. "This has to be an incredibly fine powder formed from impacts over millions of years, and it looks like the whole surface is made up of fine dust."

New images from the spacecraft's Mars orbiter camera show many never-

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Temperatures are shown as recorded on the Martian moon Phobos by Mars Global Surveyor's Thermal Emission Spectrometer, which measured temperatures at the same time the camera acquired this image. By analyzing temperature variations, scientists deduced that the surface of Phobos is covered with a powdery dust that loses its heat rapidly.

## Galileo finds source of Jupiter's rings

*System formed by dust blasted off planet's four small inner moons*

By JANE PLATT

Jupiter's intricate, swirling ring system is formed by dust kicked up as interplanetary meteoroids smash into the giant planet's four small inner moons, according to scientists studying data from JPL's Galileo spacecraft. Images sent by Galileo also reveal that the outermost ring is actually two rings, one embedded within the other.

The findings were announced Sept. 15 by scientists from Cornell University, Ithaca, N.Y., and the National Optical Astronomy Observatories (NOAO), Tucson, Ariz.

"We now know the source of Jupiter's ring system and how it works," said Cornell astronomer Dr. Joseph Burns, who reported on the first detailed analysis of a planet's ring system, along with Maureen Ockert-Bell and Dr. Joseph Veverka of

Cornell, and Dr. Michael Belton of NOAO.

"Rings are important dynamical laboratories to look at the processes that probably went on billions of years ago when the solar system was forming from a flattened disk of dust and gas," Burns explained. Furthermore, similar faint rings probably are associated with many small moons of the solar system's other giant planets. "I expect we will see similar processes at Saturn and the other giant planets," Burns said.

In the late 1970s, the two Voyager spacecraft first revealed the structure of Jupiter's rings: a flattened main ring and an inner, cloud-like ring, called the halo, both composed of small, dark particles. One Voyager image seemed to indicate a third, faint outer ring. New Galileo data reveal that this third ring, known as the gossamer ring because of its transparency, consists of two rings. One is embedded within the other, and both are composed of microscopic debris from two small moons, Amalthea and Thebe.

"For the first time, we can see the gossamer-bound dust coming off Amalthea and Thebe, and

we now believe it is likely that the main ring comes from Adrastea and Metis," Burns said.

"The structure of the gossamer rings was totally unexpected," Belton added. "These images provide one of the most significant discoveries of the entire Galileo imaging experiment."

Galileo took three dozen images of the rings and small moons during three orbits of Jupiter in 1996 and 1997. The four moons display "bizarre surfaces of undetermined composition that appear very dark, red and heavily cratered from meteoroid impacts," Veverka said. The rings contain very tiny particles resembling dark, reddish soot. Unlike Saturn's rings, there are no signs of ice in Jupiter's rings.

Scientists believe that dust is kicked off the small moons when they are struck by interplanetary meteoroids, or fragments of comets and asteroids, at speeds greatly magnified by Jupiter's huge gravitational field, like the cloud of chalk dust that rises when two erasers are banged together. The small moons are particularly vulnerable targets because of their relative closeness to the giant planet.

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# News Briefs

**Dr. Robert Nelson** of the Asteroids, Comets and Satellites Research Element 3238 has been elected vice chair of the American Astronomical Society's Division of Planetary Sciences.

Nelson's one-year term of office begins in October. The current vice chair, **Dr. Donald Yeomans**, manager of the Near-Earth Object Program Office, will assume the responsibilities of division chair at that time and will also serve through October 1999, at which time Nelson will take over as chair.

About 125 JPL scientists are members of the society's Division of Planetary Sciences, which numbers about 900 members. □

**Dr. Gregory Bearman**, supervisor of the

Earth Remote Sensing Group, Imaging and Spectrometry Systems Technology Section 385, has been appointed to the editorial board of the *Journal of Biomedical Optics*.

Sponsored by the Society for Photo-Optical Instrumentation Engineers, the journal publishes papers on applications of spectroscopy, optics and optical instrumentation to biology and medicine. □

Entries for JPL's annual Director's Office art competition will be accepted through Friday, Oct. 2.

An independent judging panel from the local art community will review submitted slides and make preliminary selections. The finalists will then bring in actual artwork for the

final selection by the jury panel.

Artists' winning entries will decorate the Director's Office suite on the ninth floor of Building 180 for a one-year period.

Complete details and submission forms are available at the ERC, Graphics (Building 111-130) and the Director's Office. For more information, call **Lynn Osornia** at ext. 4-3442. □

Signups for the Caltech Women's Glee Club will take place Sunday, Sept. 27, 1 to 4 p.m. and Monday, Sept. 28, 2 to 4:45 p.m., at the campus' Student Activities Center, Room 1.

The group's first rehearsal will be held at the same location Sept. 28, 5 to 6 p.m.

All JPL/Caltech community members are invited to join.

For more information, visit the club's web site at [www.cco.caltech.edu/~musicpgm/mhubbard/glee.html](http://www.cco.caltech.edu/~musicpgm/mhubbard/glee.html) or call (626) 395-6260. □

## Special Events Calendar

### Ongoing

**Alcoholics Anonymous**—Meets at 11:30 a.m. Mondays, Tuesdays, Thursdays (women only) and Fridays. Call Occupational Health Services at ext. 4-3319.

**Codependents Anonymous**—Meets at noon on Wednesdays. Call Occupational Health Services at ext. 4-3319.

**Gay, Lesbian and Bisexual Support Group**—Meets the first and third Fridays of the month at noon in Building 111-117. Call employee assistance coordinator Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

**Parent Support Group**—Meets the fourth Tuesday of the month at noon. Call Jayne Dutra at ext. 4-6400.

**Senior Caregivers Support Group**—Meets the second and fourth Wednesdays of the month at 6:30 p.m. at the Senior Care Network, 837 S. Fair Oaks Ave., Pasadena, conference room #1. Call (626) 397-3110.

### Friday, September 18

**JPL Dance Club**—Meeting at noon in Building 300-217.

**OEMA Technical Briefing**—"Obtaining Solutions To Radiation and Plasma-Induced Failure Modes From Physics" will be presented by

Dr. A. Robb Frederickson, Reliability Engineering Section 505. At noon in Building 180-101.

**Von Kármán Lecture Series**—Dr. Chuck Weisbin, program manager for robotics and Mars exploration technology, will speak at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

### Tuesday, September 22

**Investment Workshops**—TIAA-CREF representatives will present "Women & Money" at 10 a.m. and "Your Distribution Options" at 2 p.m. Both will be held in Building 180-101. Seating will be limited. Call Patrice Houlemard at ext. 4-2549.

### Wednesday, September 23

**Chinese Language Class**—Basic instruction in the language is offered starting at noon in Building 306-400. For information, e-mail to [wangp@rockymt.jpl.nasa.gov](mailto:wangp@rockymt.jpl.nasa.gov).

**JPL Drama Club**—Meeting at noon in Building 301-127.

**JPL Toastmasters Club**—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. Call Mary Sue O'Brien at ext. 4-5090.

**Russian Language Workshop**—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previous study of the language is essential. For location and further information,

call Joyce Wolf at ext. 4-7361.

### Thursday, September 24

**Caltech Architectural Tour**—The Caltech Women's Club presents this free service, which is open to the public. The tour begins at 11 a.m. and lasts about 1 1/2 hours. Meet at the Athenaeum front hall, 551 S. Hill St., Pasadena. For reservations, call Susan Lee at (626) 395-6327.

**JPL Atari Club**—Meeting at noon in Building 238-544.

**JPL Golf Club**—Meeting at noon in Building 306-302.

### Friday, September 25

**Caltech-Occidental Chamber Orchestra**—The program for this 8 p.m. concert at Caltech's Ramo Auditorium is to be announced. For information, call (626) 395-4652.

**JPL Dance Club**—Meeting at noon in Building 300-217.

### Saturday, September 26

**Chanticleer**—This all-male chorus presents a program that includes renaissance, vocal jazz, gospel and new music. At 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$32, \$28 and \$24. Call (626) 395-4652.

**Folk Music**—Guitarist Duck Baker will present an 8 p.m. concert in

Caltech's Dabney Lounge. Tickets are \$12. For information, call (626) 395-4652.

### Tuesday, September 29

**Eudora Training For Technical Staff**—This session for PC users features an introduction to using Eudora and its various features, and offers more detail than the sessions for business users. At noon in the Building 167 conference room.

### Wednesday, September 30

**Chinese Language Class**—Basic instruction in the language is offered starting at noon in Building 306-400. For information, e-mail to [wangp@rockymt.jpl.nasa.gov](mailto:wangp@rockymt.jpl.nasa.gov).

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### Thursday, October 1

**JPL Gun Club**—Meeting at noon in Building 183-328.

### Friday, October 2

**JPL Dance Club**—Meeting at noon in Building 300-217.

# Lab to develop miniature robots for tomorrow's soldiers

By JOHN G. WATSON

The day when tactical mobile robots will serve as military "point men," surveying enemy terrain during combat operations, is one step closer to reality with the selection of JPL by the U.S. Defense Advanced Research Projects Agency (DARPA) to lead a consortium to create a miniature tactical mobile robot for urban operations.

JPL was selected from among 50 finalists to receive the 18-month, \$4-million contract.

Drawing on robotics technologies developed for the space program, the "backpackable" micro-rover will break new ground in small robot size (under 40 centimeters or 16 inches in length), light weight, maneuverability and real-time perception for navigation and reconnaissance.

"We are pleased to have this opportunity to contribute to U.S. defense technologies and to exploit valuable synergy between space and military robotic applications in unstructured terrain," said Charles Weisbin, manager of the Robotics and Mars Exploration Technology unit in JPL's Technology and Applications Programs Directorate. "The vehicle developed by this effort will be the vanguard of a new generation of miniature, mobile, intelligent sensor systems."

The microrover will be small enough to be easily carried and deployed by a single soldier, yet

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## DS1 launch may be delayed until Oct. 25

Although JPL's Deep Space 1 mission is now officially scheduled for liftoff at 3:59:50 a.m. PST on Oct. 25 from Cape Canaveral Air Station, Florida, mission managers continue to plan for an Oct. 15 launch.

The recent change in the official launch date to Oct. 25 is due to the growing demand for launch pad time at Cape Canaveral. NASA, however, may determine to change back to the mission's original launch date of Oct. 15 or 16 if final spacecraft processing remains on schedule and if the launch support system can

accommodate the change at that time.

Deep Space 1 is the first mission of the New Millennium Program, testing and validating new technologies so that they can be confidently used for science missions of the 21st century. Although Deep Space 1 will test two science instruments and fly by an asteroid, this mission is one of the first-ever deep space NASA launches to have technology, rather than science, as its key focus. Much of the key technology testing will be completed within eight weeks of launch. □

## Mars Climate Orbiter arrives at KSC

JPL's Mars Climate Orbiter arrived at Kennedy Space Center Sept. 11 to begin final preparations for launch. The spacecraft arrived aboard an Air Force C-17 cargo plane at the Shuttle Landing Facility following its flight from the Lockheed Martin Astronautics plant in Denver. The launch of the Mars Climate Orbiter is scheduled to occur aboard a Boeing Delta II (7425) rocket on Dec. 10.

When it first arrives at the red planet, the Mars Climate Orbiter will be used primarily to support its companion Mars Polar Lander spacecraft, planned for launch on Jan. 3, 1999. After that, the Mars Climate Orbiter's instruments will monitor the Martian atmosphere and image the planet's surface on a daily basis for one Martian year, the equivalent of two Earth years. During this time, the spacecraft will observe the appearance and movement of atmospheric dust and water vapor, as well as characterize seasonal changes on the surface. The

detailed images of the surface features will provide important clues to the planet's early climate history and give scientists more information about possible liquid water reserves beneath the surface.

The spacecraft is to be readied for launch in the Spacecraft Assembly and Encapsulation Facility-2. Among the processing activities to be performed in this clean room facility are a functional test of the science instruments and the basic spacecraft subsystems.

Checks of the communications system will be performed, including a verification of the spacecraft's ability to send data via the tracking stations of the Deep Space Network to JPL and Lockheed Martin.

Following these checks, the spacecraft will be fueled with the spacecraft bipropellants of hydrazine and nitrogen tetroxide and mated to a Star 48 solid propellant upper stage booster. Finally, the combined spacecraft and upper stage elements will undergo spin balance testing.

The Mars Climate Orbiter and its upper-stage

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## Jupiter

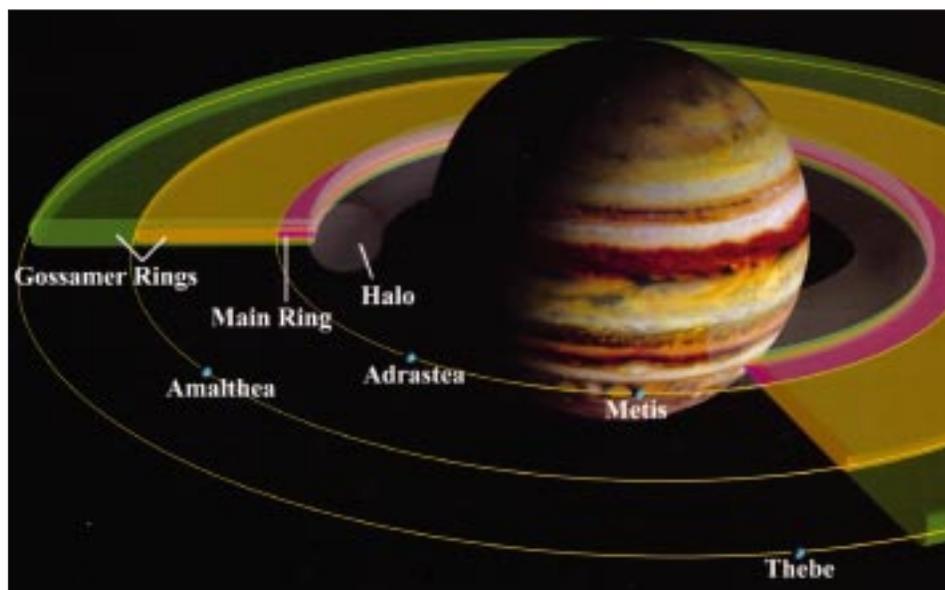
Continued from page 1

"In these impacts, the meteoroid is going so fast it buries itself deep in the moon, then vaporizes and explodes, causing debris to be thrown off at such high velocity that it escapes the satellite's gravitational field," Burns said. If the moon is too big, dust particles will not have enough velocity to escape the moon's gravitational field. With a diameter of just eight kilometers (five miles) and an orbit that lies just at the periphery of the main ring, tiny Adrastea is "most perfectly suited for the job," he said.

As dust particles are blasted off the moons, they enter orbits much like those of their source satellites, both in their size and in their slight tilt relative to Jupiter's equatorial plane. A tilted orbit wobbles around a planet's equator, much like a hula hoop twirling around a person's waist. This close to Jupiter, orbits wobble back and forth in only a few months.

Jupiter's diameter is approximately 143,000 kilometers (86,000 miles). The ring system begins about 92,000 kilometers (55,000 miles) from Jupiter's center and extends to about 250,000 kilometers (150,000 miles) from the planet.

The new images are available at the Galileo web site at <http://www.jpl.nasa.gov/galileo>. □



MRPS-91802

This schematic cut-away view of the components of Jupiter's ring system shows the geometry of the rings in relation to Jupiter and to the small inner satellites, which are the source of the dust that forms the rings. The innermost and thickest ring is the halo that ends at the main ring. The thin, narrow main ring is bounded by the 16-kilometer-wide (10-mile) satellite Adrastea and shows a marked decrease in brightness near the orbit of Jupiter's innermost moon, Metis. It is composed of fine particles knocked off Adrastea and Metis. Although the orbits of Adrastea and Metis are about 1,000 kilometers (about 600 miles) apart, that separation is not depicted in this drawing.

# Security units guard more than just gates

By MARK WHALEN

The transition of JPL's guard force to contractor Wackenhut Inc. has been extremely smooth; so much so, said Security and Plant Protective Services Section Manager Joe Charles, that "most people didn't recognize fact that the transition in June had occurred."

For most who have noticed, the major change has been a heightened visibility of the guard service's patrol cars, both around the perimeter and interior of Lab. The effort has partly been in response to the bombings of U.S. embassies in Kenya and Tanzania in early August.

At that time, Charles said, "we entered a second-stage alert and moved quickly and decisively to implement the things that were necessary to enhance the security of the Laboratory, and we had the immediate support of the deputy director's office."

Besides Larry Dumas' memorandum on all JPL personnel visibly wearing their badges at all times, other less conspicuous security measures were put into place on the Laboratory. "Dumas expressed his confidence in the Security Office as being the Laboratory's experts and making the appropriate calls to ensure Laboratory safety," Charles said.

Additional measures to tighten security included increased review of access to the Lab and heightened sensitivity to unattended vehicles—including a prohibition of overflow parking along Oak Grove Drive.

While guards provide the critical work of Laboratory access and associated functions, "Security is more than just the guard at the gate, giving people access to the Laboratory," Charles said. It's an integrated program that includes components such as protective services, law enforcement, investigations, computer security, rescue and fire services, and emergency preparedness.

For example, the Administrative Security Group is expected by mid-October to have provided new badges for all JPL personnel. Within two or three weeks of that, new and quicker badge proximity readers are set to be installed at all entrance gates.

Probably the most unrecognized portion of the organization, Charles said, is the investigative unit, which handles procedural and legal investigations such as ethics violation allegations, threats, violence, misconduct allegations, thefts and stalking. The unit's primary goal is to gather facts and present them to Office of the General Counsel, who in turn presents them to line management and Human Resources for remediation.

Charles' staff also works with the Lab's communications information officer in areas of computer security. A major area of concern cropped up earlier this year when hackers broke into the Laboratory's web site.

"We work closely with NASA's Office of Inspector General and share information on computer intrusions with them almost daily," Charles noted.

The Lab's first line of defense for fires, hazardous material spills, medical emergencies, rescues and other areas fall to the fire department, which, along with volunteer members of the Emergency Preparedness Program, constantly trains with other emergency agencies to always be in a state of readiness. Emergency preparedness is a major aspect of Security and Protective Services, Charles said.

"I wouldn't attempt to guess how much they

have helped in saving lives," he said. "They work at great risk to themselves, and that speaks to the great dedication of this organization and what its prime responsibility is to the Lab and to the people who work here—to create a secure environment.

"We have a very professional work force at JPL," he added. "Couple that with the fact that everyone is cognizant of security and that our personnel are well-trained, knowledgeable and experienced. A number of managers and employees have expressed their comfort in the workplace because security is professionally handled." □

## *Pedestrian, traffic safety rules noted*

JPL's unique, 176-acre facility was not designed with traffic in mind, and it is incumbent on both drivers and pedestrians to look out for each other, said Alison Weisbin of the Safety Operations Section.

It is the responsibility of pedestrians to cross roads only at crosswalks, but some extra care needs to be taken at some blind crossings on Lab, particularly at the south gate, adjacent to the credit union.

Before crossing any road, she added, "remember to make eye contact with the vehicle's driver."

Drivers' responsibilities include observance of a 10 mph maximum speed on all parking lot roadways, unless otherwise posted. Also unless otherwise posted, the speed limit on all other Lab roadways is 20 mph.

Just as on public roads, anyone who drives on Lab must have a valid driver's license and vehicle registration with them. In addition to observing crosswalks, drivers must at all times obey all other traffic controls, including stop signs and one-way street designations. Drivers who operate a vehicle in an unsafe manner or impede traffic will be cited by security officers. □

## Employee Assistance Program offers stress-reduction class

The JPL Employee Assistance Program's presentation of "Staying Healthy During Times of Change" on Sept. 24 is part of its ongoing service of providing sections and divisions with classes and groups on organizational change and stress prevention.

The presentation will be held at noon in von Kármán Auditorium, said Cynthia Cooper, employee assistance coordinator.

"We have had a very favorable response from participants and managers," she said. "It is very helpful for employees and managers to understand the different phases of change and how it can impact individuals and teams. It is also extremely important to understand how our bodies react to stressors, whether positive or negative, and utilize techniques to stay healthy."

The Employee Assistance Program, part of the Occupational Health Services Office, will continue to provide these classes and groups as a part of the Laboratory's commitment to wellness. "In Occupational Health Services, we believe that if you don't make the time to be healthy, you will have to take the time to be sick," Cooper said.

The program also provides individual assistance to employees on other issues, such as family problems, chemical dependency and financial- and work-related problems. All contacts are confidential and protected by laws on counselor/patient privilege.

For individual counseling or a group presentation, call ext. 4-3680. □

## 'Lessons learned' now easier to locate

To help avoid costly mistakes of the past, JPL projects are strongly encouraged to review the Lab's "lessons learned" on the Develop and Maintain the Institutional Environment (DMIE) Navigator Lessons Learned Channel at <http://elias/lessons>. The site includes more than 150 "official" lessons, 130 recently installed archived lessons and historical space-flight significant events.

The lessons-learned process involves weekly Lessons Learned Committee reviews of problems and issues from all Lab projects and organizations, as well as non-JPL missions, evaluating them for current and future applicability and, "hopefully, presenting them in a concise and meaningful manner," said Jim Clawson, manager of the Reliability Engineering Office and committee chairman.

The committee generally limits the lessons and recommendations to fairly high-level issues without unnecessary technical detail, he said, adding that detailed electronic parts design issues are not usually considered, but misapplication of such parts is a frequent subject, as are hardware handling incidents, subsystem design issues, system design/interaction problems and specific hardware issues.

Committee members have found this activity personally rewarding and of significant value to the Lab over the years, according to Clawson. "Our open forum on all issues—technical, programmatic and institutional—promotes Labwide communication," he said.

See Lessons, page 6

# Kansas student, hometown counterpart meet up on Lab

By MARK WHALEN

For her winning entry in a nation-wide science contest this summer, Kansas high school student Katie Griffin earned a one-week internship at JPL, which she fulfilled in August. She won the honor based on her detailed proposal to explore Jupiter's moon Europa with a lander and rover.

Griffin, a junior at Shawnee Mission West High School in Overland Park, Kan., has had an interest in space since the sixth grade. She and an escort spent a whirlwind six days touring JPL and Caltech, visiting with scientists and mission planners, thrilled to experience how real space science is done.

This was Griffin's first visit to California, but she didn't have time to go to Disneyland during her stay. However, her meeting with one

JPL scientist proved that it is indeed a small world after all.

What are the odds that a teenager from a suburb of Kansas City, Kan. with an interest in Europa would come to JPL and hook up with a scientist from the same hometown, who happened to have worked on Europa studies?

It happened when, about a month before Griffin left for JPL, the parents of Lab employee Dr. Tom Spilker, a 1970 graduate of Shawnee Mission West, noticed an article in a Kansas City newspaper that highlighted her winning the National Science Teachers Association Space Telerobotics internship contest and noted her impending trip to JPL.

Spilker contacted Rich Alvidrez, manager of JPL's Public Education Office, who hosted Griffin during her visit. A week before she left, Alvidrez let her know about Spilker, and arranged a meeting between the two.

Meeting Spilker was "weird," even "paranormal," said Griffin, "but it was also neat because he went to Kansas State, and one of the places I'm considering going to is Kansas University. To hear someone going along almost the same path I'm looking at, in the same area of study I'm interested in, is just really great."

"She is certainly an intelligent, very bright and enthusiastic young woman," said Spilker, who as a science representative to Team X has participated in preliminary feasibility studies for a Europa orbiter, "and that will prove to be a powerful combination for her future."

Griffin noted one of the best parts of her visit was when Spilker drove her up to the Mt. Wilson Observatory to check out the Telescopes In Education telescope, followed by a star party. Also among her notable stops were the Microdevices Laboratory and the Deep Space Network at Goldstone.

This is the second straight year Griffin has won a NASA internship. Last year, as a freshman, her proposal—which landed her a trip to Kennedy Space Center—focused on terraforming Mars, which "was much more visionary," she said. "It was almost like science fiction, because I got to talk about a spacecraft with simulated gravity, long-term spaceflight needs and things like that.

"I hope my proposal this year is a little more accurate (than science fiction); I was trying to pattern it after the Sojourner rover for Europa, with more virtual reality aspects. It has drilling apparatus underneath it to go a few feet down.

"It was really more of a mission to learn more about the planet before sending a bigger ship to it."



Dr. Tom Spilker shows Europa photos to contest winner Katie Griffin.

## Contractors chosen for SIM

By JANE PLATT

JPL has selected Lockheed Martin Missiles and Space of Sunnyvale and TRW Inc., Space and Electronics Group of Redondo Beach for negotiations as industry team members for the Space Interferometry Mission (SIM).

SIM is an innovative space system that will be launched in 2005 to precisely measure the location of stars and to search for planets orbiting nearby stars. SIM is part of the Origins Program, a long-term program to enhance our understanding of the universe and search for life beyond Earth.

The total value of these two contracts, including the mission formulation and implementation phases, is estimated to be in excess of \$200 million. The initial contracts will cover the mission's formulation phase, with an option for the implementation phase. During the formulation phase, initial mission design and planning for full-scale implementation will be completed.

"This marks the start of what we envision as an exciting and productive relationship with our industry team members," said Chris Jones, SIM project manager at JPL.

SIM will be placed into an Earth-trailing orbit around the sun. Its multiple telescopes will be used in pairs; the light they gather will be collected and processed to pinpoint the position of stars. The system will synthesize images that could normally only be obtained with a much larger telescope. It also will demonstrate the ability to "null" or cancel out the light from a star, which will help enable future missions to obtain a direct view of planets around other stars. Interferometry will play a key role in several missions of the Origins Program.

SIM will search for planets beyond our solar system by watching for the telltale wobble motion of a star, which indicates the gravitational tug of an orbiting planet or planets. SIM also will image the regions immediately surrounding massive black hole candidates in the nearest galaxies, measure the distances to half a dozen nearby galaxies, and study other celestial objects. □

She reads The Planetary Report and regularly checks out NASA web sites for research, which apparently showed in her winning contest entry on Europa. This didn't escape the notice of Alvidrez, who said, "Her proposal was far superior to entries from other students who were judged by the Educational Affairs Office."

Griffin's interest in space is really a hobby, she said, since her high school doesn't offer astronomy classes, but that doesn't deter her from pursuing the subject in other ways. Noting that an independent study class allowed her more time to do Internet research on space-related topics, she said with a laugh, "Sometimes I've let teachers know that, in my opinion, they could apply some of the things they're teaching to space and science.

"Most of the teachers are open to that. They're all real supportive. I always do their (assigned) classwork, but they know space is always in the back of my mind . . . they're nice about it. It's cool."

Spilker noted that in the past few weeks he had the chance to revisit his youth a bit in the Kansas City area and arranged to go back to his old high school. Griffin joined him, as did her science teacher and mentor Ken Bingman, who got her interested in entering the internship competition.

In another coincidence, Bingman's wife, Mary, served as Griffin's escort during her trip to JPL; Spilker had known Ken Bingman from high school, 30 years earlier.

Though Griffin's time at JPL was quickly over, she may be back in the area soon, saying "Kansas University is an extremely likely possibility; but I'm also considering applying to Caltech. Even if I don't decide to go there for undergrad, it's certainly on the top of my list for graduate school."

What stood out the most about her visit to both the campus and JPL, she said, "is how nice and helpful everyone has been. It's also nice to see that everyone's so excited about what they're working on. It's incredible to just walk by people who are so interested in space like I am . . . I didn't have to prompt it." □



KENNEDY SPACE CENTER PHOTO

Technicians check the connections on the workstand holding the Mars Climate Orbiter in Kennedy Space Center's Spacecraft Assembly and Encapsulation Facility (SAEF) -2.

## Orbiter

Continued from page 3

booster will be transported to Complex 17 on Nov. 30 for hoisting atop the Delta and mating to the second stage. After the spacecraft undergoes a state-of-health check the next day, the two halves of the fairing will be placed around it on Dec. 3.

The eight-day primary launch period to achieve an optimum cruise phase and Mars planetary encounter begins with an instantaneous launch window at 10:56 a.m. Pacific Standard Time Dec. 10. There are two instantaneous windows each day. A secondary six-day period of launch opportunity begins Dec. 18. The last day available for launch is Dec. 25. □

## Robotics

Continued from page 3

rugged enough to survive impacts when tossed over fences, window sills and other barriers. It will be able to climb stairs and other obstacles quickly, and be capable of conducting detailed surveying and mapping of indoor and outdoor environments, and detection and localization of hostile forces.

"We have spent a lot of time and energy analyzing employment concepts for portable robotic platforms over the last few years and are convinced of their revolutionary impact on dismounted warfare," said Lt. Col. John Blich, former chief of unmanned systems at U.S. Special Operations Command and current program manager for DARPA's Tactical Mobile Robotics Program.

In support of building-clearance operations, a tactical mobile robot could be tossed in a doorway, pointed down a hall and commanded to scurry along the wall or climb multiple flights of stairs until side-looking laser sensors detected a doorway or branching hallway. It could detect hostile entities, deactivate booby traps, deliver payloads or simply stop and listen

## Lessons

Continued from page 4

Various project representatives from the Office of Engineering and Mission Assurance, environmental requirements engineers, reliability engineers, quality assurance representatives, etc., are heavily involved in the effort.

JPL lessons are also available on the NASA-wide Lessons Learned Information System at <http://llis.gsfc.nasa.gov>. Industry partners are generally granted electronic access to the NASA system by sending a request to Clawson.

New lessons learned developed thus far during fiscal year 1998 include:

- Avoid Inadvertent "Hot" Mates or Demates of Connectors
- Battery "Popping" During ATLO Due to Horizontal Mounting
- Cassini-Huygens Probe On-Pad Cooling Incident
- Informal Design Reviews Add Value to Formal Design Review Processes
- Interface Control and Verification
- Mars Global Surveyor Aero-breaking Extra Burn Anomaly
- Mars Pathfinder Avionics and Flight Software Architecture
- Mars Pathfinder Flight Software Development Process
- Provide Software Checks On All Spacecraft Command Constraints
- Staff Continuity Enhances Low Cost, Rapid Development Projects
- Test Contingency Planning Should Consider Facility Power Interruptions
- Verify CAD/CAM Software Compatibility Between Organizations Before Proceeding to Hardware Fabrication
- Verify Vendor Certification of Commercial Equipment

All JPL employees are encouraged to submit potential lesson topics for review by committee members. □

with its acoustic/vibration system before continuing reconnaissance of the new area.

Outdoors, the robot could travel and hide along the curb of a street to look around the next intersection. It could traverse in a ditch, pausing occasionally to listen, or be deployed to use the video motion detection capability, acting as a wing-man to cover the soldier's flank.

Consortium members and their contributing areas of expertise include IS Robotics, Somerville, Mass. (robotic platforms); Carnegie Mellon University, Pittsburgh (perception); the Oak Ridge National Laboratory, Oak Ridge, Tenn. (mapping), and USC (operator interface).

Building on designs created during a six-month, \$400,000 first-phase contract completed last year, the consortium is now contributing to DARPA's Tactile Mobile Robotics Program during a second phase by developing the miniature rover prototype.

Completion of this second-phase project is scheduled for the end of 1999.

More information on JPL's robotics activities is available on the Internet at <http://RMET.jpl.nasa.gov/RMET/index.html>. □

## Phobos

Continued from page 1

before-seen features on Phobos, and are among the highest resolution ever obtained of the Martian satellites. A 10-kilometer-diameter (six-mile) crater called Stickney, which is almost half the size of Phobos itself, shows light and dark streaks trailing down the slopes of the bowl, illustrating that even with a gravity field only about 1/1,000 that of the Earth's, debris still tumbles downhill. Large boulders appear to be partly buried in the surface material.

Infrared measurements of Phobos were made on Aug. 7, 19 and 31 from distances ranging between 1,045-1,435 kilometers (648-890 miles), far enough away to capture global views of the Martian moon in a single spectrum. The instrument has been able to obtain the first global-scale infrared spectra of Earth and Mars in addition to the new Phobos data, bringing new insights about the composition of these three very different worlds.

"Of the three, Earth has the most complex infrared spectra, primarily due to the presence of carbon dioxide, ozone and water vapor in its atmosphere," Christensen said. "Mars, which is much colder than Earth because of its distance from the sun, is less complex and shows only significant amounts of carbon dioxide. The spectrum of Phobos, however, has little structure because it has no atmosphere and the energy it emits is coming entirely from its surface."

The new Phobos images and thermal spectrometer measurements are available on the Internet at <http://photojournal.jpl.nasa.gov>.

Global Surveyor was scheduled to begin its second phase of aerobraking Sept. 17, using the friction from repeated passes through Mars' atmosphere to lower and circularize the spacecraft's orbit. Over the next four-and-a-half months, the spacecraft's flight path will be lowered from the current 11.6-hour elliptical orbit to a two-hour, nearly circular orbit over the Martian polar caps. The magnetometer and thermal spectrometer will be turned on through December to gather data each time the spacecraft passes closest to Mars' surface. In addition, the radio science team will be conducting gravity field experiments by measuring small shifts in the spacecraft's velocity as it passes behind the planet or is blocked from view by the Sun.

The JPL/Lockheed Martin Astronautics spacecraft team is continuing to study possible options for deployment of the spacecraft's high-gain antenna once it has reached its low-altitude mapping orbit next spring. □

## Retirees

The following employees retired in September:

**Howard Eyerly III**, 37 years, Section 515; **Christopher Carl**, 35 years, Section 390; **Donna Shirley**, 31 years, Section 400; **Paul Henry**, 27 years, Section 385; **Ronald Burt**, 25 years, Section 506; **Patricia South**, 21 years, Section 644; **Russell Brill**, 18 years, Section 345; **Elisabeth Dettinger**, 12 years, Section 100; **Dorothy Huffman**, 10 years, Section 314. □

## August NOVA winners announced

The winners of JPL's Notable Organizational Value-Added (NOVA) awards for August have been announced:

**Section 100:** Winston Gin.

**Section 107:** Helen Paley, Emily Santana.

**Section 109:** Deborah Johnson.

**Section 181:** Jack Dawson.

**Section 210:** Charles Crawford, Benjamin Dominguez.

**Section 211:** Norberto Munoz, Trung Nguyen, Gary Ureda, Cynthia Williams.

**Section 212:** Deborah Arguello, Linda Bakhoun, Betty Davis, Bonnie Dean, Daniel Graham, Laura Hollis, Delora Knowles, Deborah Lewis, Leah Miller, Lynette Miller, Juan Montoya, Lynda Noell, Hildegard Pitters, John Porretta Jr., Bobbi Ray, Sally Rose, Barbara Sherrod, Josephine Soliz, Desiree Trevizo, Kathleen Ulrich, Lillie Varnado.

**Section 213:** Melinda Van Der Geugten.

**Section 214:** Brigitte Badea, Jennifer Berlien, Yvonne Bornhauser, Ronald Roberts, Robyn Young.

**Section 215:** Marilyn Miller.

**Section 222:** Anita Ho.

**Section 240:** Marc Montgomery.

**Section 300:** Ted Sivalon.

**Section 313:** Jacqueline Akers, Maurice Argoud, Magdy Bareh, Wayne Boncyk, Mark Boyles, John Burt, Catherine Cagle, Dennis Cate, Ronald Cohen, J. Brian Costello, Karen Cramer, Dung Doan, David Durham, Anne Elson, Hershail Fitzhugh, Robert Gaston, Carolyn Gil, Tom Huynh, Alejandro Jimenez, Peter Kahn, Joel Krajewski, P. Douglas Lisman, Thomas Pagano, Maria Sliwinski, Donald Starkey.

**Section 314:** Stephen Booth, John Camakis, William Dias, Suzanne Dodd, Susan Linick, Saturnino Lopez, Ellen O'Leary, Rodney Reed, Marie Slonski, Bruce Waggoner, G. Allison Whyte.

**Section 331:** Andrea Barbieri, Abhijit Biswas, Juan Cenicerros, Paula Eshe, Raymond Jurgens, Gerardo Ortiz, Angel Portillo, Paul Robbins, John Sandusky, Robert Sniffin, Meera Srinivasan.

**Section 333:** Eleanor Manning.

**Section 335:** Natividad Chavira, Susan Finley, David Fort, Charles Goodhart, Andre Jongeling, Robert Navarro, Jeff Piero, Robert Proctor, David Rogstad, Elliott Sigman, Leslie White.

**Section 336:** Kermit Pederson.

**Section 341:** Rozita Belenky, Leo Bister, Daniel Eldred, John Essmiller, Robert Grogan, Shin Huh, Edwin Kan, Mario Mora, Tracy Neilson, M. Shirbacheh, Eli Skulsky, Edward Swenka, Terry Wysocky.

**Section 344:** Paul Moomjean.

**Section 346:** Michael Hoenk, Sam Keo, Annette Laste, Edward Luong, Jason Mumolo, Bill Nesmith, Shouleh Nikzad, David Perrone, Tasha Turner, Leslie Zoltan.

**Section 350:** Marc Broom, Howard Eisen, Arthur Franzon, Richard Grippi Jr., William Layman, Elsa Waters.

**Section 352:** Kevin Burke, Aaron Fishman, Bruno Jau, Satish Krishnan, Chin-Po Kuo, Don Noon, Dara Sabahi, Sergio Valdez, Christopher Voorhees.

**Section 353:** John Anderson, Jack Barengoltz, Lloyd French, Robert Frisbee, Charles Garner, Keith Goodfellow, Richard Helms, Thomas Hill, James Kulleck, Daniel Lacanilao, Elly Ponce, Thomas Reame, Robert Shotwell, Georg Siebes, David Soules, Daniel Taylor, Jeffrey Weiss, Liang-Chi Wen, Andre Yavrouian.

**Section 357:** Kathryn Iwanaga, Raymond Kariger.

**Section 386:** Paul Batelaan, Steven Dinardo, Michael Gaidis, Wenonah Green, Karen Lee, Robert Lin, Catherine Magnano, Suzanne Martin.

**Section 387:** Raul Romero.

**Section 389:** Christopher Hawley.

**Section 391:** Joe Diep, Chester Joe, Robert Ryan.

**Section 393:** Lancert Foster.

**Section 490:** Susan Hofmann.

**Section 620:** Fraser Draper, Sharon Duncan.

**Section 621:** Gordon Campbell Jr.

**Section 622:** Amanda Beckman.

**Section 623:** Leslie Berridge, Francine Fisher, Joyce Grunwald,

Richard Hillquist, Steven Simpson.

**Section 640:** Willis Chapman.

**Section 642:** Pedro Abeyta, Yvonne Barraza, James Black, Rory Carey, Ross Curtright, David Davis, Larry Dean, Dennis Ferren, Jerry Harter, Gerald Hicks, David Klein, Tony Reichert, Sunny Schofield, Bruce Troutman, Tommy Worrel, Michael Wright.

**Section 643:** Barbara Amago, Teresa Bailey, Patty McCauley, Kimberly Orr, Gwen Partridge.

**Section 644:** Stephen Benskin,

Robert Brown, Roger Carlson, C. Nelson Carter, Charles Cordaro, David Deats, Patricia Ehlers, Faye Elman, Susan Foster, Kenneth Gowey, John Gregoire, James Jackson, Takashi Kiriyama, Carol Lachata, Marilyn Morgan, Mary Sue O'Brien, Audrey Riethle, Patricia South, Ellen Trevarthen, Jeanné Washington, Linda Worrel, Thomas Wynne.

**Section 660:** Bruce Fischer.

**Section 720:** Carolyn Loewenstein.

**Section 783:** Kent Kellogg. □

## ISO assessment focuses on corrective action

By KERRY LYN CASSIDY  
*ISO 9001 Implementation Team*

Round 3 of JPL's ISO 9001 assessments generated 60 corrective action notices across the Lab. These notices indicate places where JPL is not in compliance with the ISO requirement to "do what you say, say what you do and prove it;" in other words, the places where documentation does not match or is not aligned with work as performed on a day-to-day basis.

The procedure for generating a corrective action notice, then making sure that the inconsistency is corrected, requires an important interaction between process owner, lead assessor, and line organization or projects.

The corrective/preventative action procedure is based on the current PFR (Problem Failure Reporting) system, which has been in place at JPL since the 1960s. The PFR system is a corrective action system used by the projects that applies to flight hardware, software and ground support systems. However, it does not apply to all JPL processes. The corrective/preventative action system has been created to cover these areas of endeavor.

The basic procedure for a corrective/preventative action involves: identifying a problem, validating that it actual-

ly occurred, assigning a responsible party, determining the root cause, instituting a corrective/preventative action and proving the effectiveness of that action. There is also a procedure in place for review and tracking by high-level management of any key issues.

Inputs to the corrective/preventative action system can come from a variety of sources, both internal and external—including customer complaints and stakeholder issues—in addition to all employees on Lab.

A corrective/preventative action software tool is currently being developed and will be online at the end of September. Classes will be offered to train employees and management on use of the online tool as well as on the important steps for management to follow once a corrective/preventative action has been generated.

The Round 4 internal assessment—which has the objective of preparing JPL for the Nov. 16 external audit—took place for four days beginning Monday, Sept. 14. The assessment closely resembled that upcoming audit, with an emphasis on compliance to ISO 9001 requirements, the corrective action cycle and an assessment of documented processes as they relate to the ISO requirements. Audit preparation worksheets that group supervisors received for distribution to their groups should be valuable for use by employees in interviews with assessors. □

## LETTERS

I would like to say thank you to everyone in Section 662, my friends and ERC for their kind thoughts and flowers after the death of my brother.

Frank Moreno  
□□□

My very belated but nonetheless heartfelt and sincere thanks to all of those who attended my retirement parties. It has been a pleasure working with all of you over the years and I hope to maintain contact in the future. Special thanks to Linda Miller and Steve Manion for the thoughtful preparations, effort and gracious hosting of the party at their home.

John T. Rice

## FOR SALE

BABY ITEMS: crib and mattress \$100; chest of drawers & changer \$150; car seat/carryer \$50; others at reasonable price; all in vg condition. 248-8853.

BASKETBALL SYSTEM, Huffy, never used, cost \$150, sell \$75/obo. 626/284-8766.

BEDROOM SET, king w/matt., box springs, armoire, double dresser w/double mirrors, 2 nightstands, white/gray, gd. cond., \$275. 626/355-8409.

BEDROOM SET, oak, beautiful, purchased new Aug. 11; queen bed (matt., box springs & frame); oak, modern headbr w/2 nightstands; must see, close to JPL; selling because moving

to furn. apt.; \$500/obo. 626/795-9736, Muli. BICYCLES, specialized 1991 Allez, 24-inch carbon fiber frame, Sountour 12-speed shifters, very light and stiff, choice of triathlon or std. drop bars, Look pedals, \$400 firm; Fuji 12-sp, 23-inch frame, gd condition, aluminum wheels, Sountour shifters, \$100 firm. 626/794-0886, Ted. BICYCLES, men's and ladies', \$40/ea.; men's 5-sp. beach cruiser, \$50; girls' 20", \$20; men's Schwinn, \$40. 626/289-2688.

BRIDESMAID/EVENING GOWNS (2), elegant, used once, med. sz., matching shoes, \$35/ea./obo. 248-1326.

CAMERA, Fuji Discovery 900 zoom multi auto-focus, 38mm-85mm; features: landscape, af lock, self timer, drop in loading, pre-winding and others; takes great pictures, easy to use; sell at blue book price of \$170. 241-3779.

CANISTERS, ceramic, for tea, sugar, coffee; two 5" diameter and two 6" diam.r; white w/blue flower designs; all 4 for \$6/obo. 626/568-8298. CAR SEATS (2), Century, \$25/ea., POTTY, \$5. 626/355-9733.

COMPUTER, Northgate 486, 25 MHZ, loaded, gd cond., best offer. 626/795-3859.

COMPUTER, Power Computing 120MHz 601 (PowerMac 7300 clone), 48 MB RAM, 500 MB HD, MacOS 7.5.5, incl. bundled software, \$600/obo. 626/568-9890, Alan, after 7 p.m. COMPUTER, 286 PC & keyboard, \$20; Epson LQ-500 dot-matrix printer with cable and spare

ribbons, \$20; 14" color EGA monitor, \$20; all in vg condition; entire system, \$50. 790-3217.

COMPUTER DESK, 35.5" wide by 83" high, faux wood finish, \$30. 626/398-3381, eves.

COMPUTER POWER CONTROL CENTER, 5 power switches + 1 master switch, 5 surge-protected outlets + 2 modem/fax/phone jacks, new, \$20. 790-3899.

COMPUTER TABLE, light oak, w/seat, \$50. 248-2807.

DINING ROOM SET, 6 chairs. \$300; COUCH, \$200; CHILD'S BED, mattress, like new, \$200. 626/445-6100.

DINING TABLE, formal, elegant 6-foot long, 1" thick beveled glass, with glass "V" shaped pedestals and 4 high-backed black chrome & brocade chairs; perfect cond., all for \$525/obo. 951-9635.

DINING TABLE, octagonal, beveled-glass top w/pine frame, metal pedestal, \$25; BED-

SPREAD, double, eggshell/ivory, tailored, quilted, never used, \$55; TELEPHONE, Sony, cordless, works fine, \$25; TAPE RECORDER, Sony, reel-to-reel, mint cond., \$25. 909/593-4046 (LaVerne).

DRESSERS, two units, oak, 5 drawers each, exc. condition, 36" w x 46.5" h x 17" d; \$180 each, both for \$300/obo. 626/568-8298.

DRYER, Maytag, 240V, model HDE 308, 15 yrs., fully featured, 2 temps, 3 cycles, runs great, vg cond., \$100. 626/296-8633.

EXERCISE BIKE, new Airdyne Pro Schwinn, professional quality for home gym, paid over

\$800, sell for less. 805/288-2235.

FILING CABINET, 4-drawer, letter-sized, tan metal, 15" wide x 25" deep, exc. cond., \$40/obo. 626/791-7645.

FUTON and frame, Ikea, single, exc. cond., used once, \$50/obo. 323/665-3439.

GATES (children's safety), expandable, 27"-41" long, 25" high, plastic-coated wire mesh, wooden frame, exc. cond.; 2 @ \$10/ea. 626/285-9103.

GAZEBO, Cal Spas, 16' x 12' redwood, enclosed; 220V, 40 max., spa 10' x 10'; incl. 1 table w/ 4 chairs, 1 bar table w/4 stools, 4 redwood planters; vg cond., \$2,700. 626/444-6156, Bob or Annie.

HAIR DRYER, professional, chair style, works well, \$35/obo. 956-1744.

HIGH CHAIR w/detachable tray, Graco, gd. cond., \$10. 626/285-9103.

KITCHEN/LAUNDRY APPLIANCES, being replaced due to remodeling; all currently in use and work well; Whirlpool washer & gas dryer; Sears undercounter dishwasher; Penny's microwave; Kenmore 30" free-standing gas range; Kenmore side-by-side 19 cubic ft. refrig./freezer; \$50/ea. item. 790-4455.

LAWN MOVER, McClane, 17" front-throw reel, self-propelled, \$250/obo. 957-4770.

MODEM, Supra Express for Mac, external, 56K, \$50. 626/334-2644.

ORGAN, Yamaha 415 electronic console w/13 pedals, 3 keyboards, 144 rhythm patterns, pd.

Continued on page 8

\$7,500, sacrifice for \$3,000. 790-3899.  
**PLANTING POTS:** heavy, red clay, 16"-20" diameter, matching elegant, modern style, \$15-\$20 each. 626/285-9103.  
**PERSONAL INFORMATION MANAGER,** Seiko "Phone-Pal", \$25. 790-3899.  
**PRINTER,** HP Laserjet 3, needs minor serv., best offer. 626/795-3859.  
**RABBIT & CAGE;** female rabbit with 3.5' x 3.5' cage, \$50/obo. 626/797-8898.  
**SANDBOX,** heavy plastic green turtle style, w/lid, 4' diameter, vg cond., \$20. 626/285-9103.  
**SKIS,** boots, bindings, 205 cm, cheap, make offer. 626/796-7584.  
**SOFTWARE** for Mac, all \$25 and under. 790-3899.  
**SOFTWARE** for Windows, never used, Windows 95 complete version w/Fat 32 (\$59), Office 97 CD tutorial (\$10), Word 97 (\$25), WordPerfect Suite 7.0 (\$25), Print Studio Window Draw Premier Edition with clip art bonus (\$25), Adobe Photodelux (\$25), IBM Via Voice (\$19), Windows 95 tutorial (\$10), New Snappy 3.0 Video Capture (\$79), Decent 2 (\$10), Deluxe typing tutorial (\$10), Compton's New Century CD encyclopedia (\$10), HP gold blank recordable CDR (\$4). 626/335-4409.  
**SPEAKERS,** 2 Acoustic Research AR2AX, gd. cond., best offer. 626/795-3859.  
**SPRINKLER VALVE ADAPTERS,** Lawn Genie automatic, new, model 756LG 3/4, \$10/each. 790-3899.  
**SWEATER,** Coogi, from Australia, size small/medium, new, sells for \$325 in Nordstrom; \$100. 790-3899.  
**TABLE,** dining rm, round, mahogany; sits 8 w/2 extensions; almost new; comes w/6 matching chairs; \$700/obo. 626/568-8298.  
**TABLE,** for dining or workspace; 60 x 36 x 30 (L x W x H); oak top, white detachable legs; exc. condition, \$50. 547-0705.  
**TABLE TOP,** curly maple, 47-inch diameter, vg cond., \$75/obo. 547-0705.  
**TRADING CARDS,** X-Men, approx. 100, dated 1992, includes set of 3 holofolios. 790-0335.  
**TV,** color console 27" Magnavox, exc. cond., \$250. 626/287-4249.  
**WINDOW SHUTTERS,** wood, interior, painted white, 14 3/4" wide x 67" high, 4 avail., exc. cond., \$30/obo for all 4. 626/791-7645.

## VEHICLES / ACCESSORIES

'87 BMW 325; white w/beige interior, 190k miles, 4-door, 5-spd., CD player, sunroof, replaced radiator, timing belt and a/c in '97, great car, \$4,000. 626/446-4969.  
 '82 BUICK Le Sabre, rebuilt engine, new brakes, new paint, runs well, \$900/obo. 957-6223.  
 '90 CADILLAC De Ville, 4-dr., gray/blue lthr., 89K orig. mi., exc. cond., recent tune-up & computer cont. replaced, \$9,000. 626/285-3810.  
 '80 CHRYSLER Cordoba, 1 owner, well kept and cared for, \$1,500. 626/791-7313.  
 '96 FORD Contour, black w/gray interior, 30,000+ mi. (add'l warranty avail.), tinted rear/side windows, a/c, cruise, prem. sound, rear seats fold down, remote access, pwr. locks, 5-6, 5-spd, \$11,500. 362-3358.

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## Universe

<http://www.jpl.nasa.gov/info/universe>

### Editor

Mark Whalen

### Photos

JPL Photo Lab

Universe is published every other Friday by the Public Affairs Office of the Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109.

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'91 FORD Thunderbird, new paint, tires and rims, exc. cond., \$7,900/obo. 626/578-7226.  
 '90 HONDA Accord EX, cobalt blue, tan lthr., auto, a/c, sunroof, non-smoker, anti-theft, exc. cond., 84,000 mi., \$6,200. 626/281-8954.  
 '85 HONDA Shadow 700cc; V-Twin, shaft drive, automatic valve adjustment, water cooled; excellent tires, low maintenance, reliable, good condition; red and black; \$1,700. 626/794-0886, Ted.  
 '86 MERCEDES BENZ 190E, champagne, gd. cond., auto, sell as is, \$3,350. 790-3802, Bill.  
 '80 NISSAN 4X, new eng., exc. cond., \$2,000. 213/255-7932.  
 '85 PORSCHE 911 Carrera, 1 owner, all service, 94K mi., exc. cond., \$18,950. 619/429-1247.  
 SAILBOAT, 13.5-ft. Firebird, great learning boat for youngsters, simple lateen sail system, foam-filled fiberglass hull with all aluminum fittings, easy to carry on car top, \$150. 626/791-5045.  
 '84 TETON 5th-wheel trailer, 40' Atlanta III, 3 slideouts, sbs fridge, conv. microwave, 2 a/c and furnaces, 2 fans, 7kw Onan gen., HHW hydraulic lifters, awnings, new tires, no smoking, mint cond., in Palm Springs. 760/345-3713.  
 '93 TOYOTA Avalon, exc. cond., white gold pkg., tan interior, \$25,000/obo. 626/578-7226.  
 '86 TOYOTA Corolla, 4 sedan, auto, a/c, gd. cond., \$2,900/obo. 626/578-7226.  
 '86 TOYOTA Tercel HB, 4-spd., air, am/fm/cass., new paint/tires, runs great, \$1,800. 541-2067.  
 '85 TOYOTA Supra, runs great, looks good, fun to drive, DOHC-6, 5-spd, a/c, PW, PL, remote locks/alarm, power sunroof, \$2,900, make offer. 626/284-9424.  
 '85 TOYOTA Tercel wagon, 5 speed, AC, PS, sunroof, good cond., \$1,300. 213/221-8620, Richard.  
 '98 TAHOE 24' trailer by Thor, queen-sz. bed, sofabed, dinette-bed, microw., awning, air, stereo, all amenities, used 3x, \$11,500. 805/533-4255.  
 '70 VW Bug, rebuilt eng.; new: seats, chrome wheels, tires and battery; not running, needs wiring completed; tags and title current; \$950/obo. 626/309-0429.

## WANTED

BICYCLE, man's, wide tires, for use around campus. 626/798-3646, Jerry.  
 ENCYCLOPEDIA BRITANNICA books of the year; '87 for events of '86, '91 for events of '90. 626/914-4441, Paul, lv. msg.  
 GARDENER recommendations for 7,500 sq. ft. yard in San Gabriel; mow, prune, plant, fertilize, etc. 626/284-9424.  
 HAMMOCK, double. 541-0782, Wendy.  
 HOME RENTAL for JPL postdoc and family; seeking well-maintained 4-bd. (or 2 bd. + 2 office) house w/garage (or workshop space), fenced yd., quiet neighbor'd, starting last wk. of Sept.; 619/284-0207, Karen or Randy, or e-mail kbrinton@ucsd.edu.  
 ROOM/APT. for German Ph.D. student visiting JPL for 8-9 mo. starting Sept 5; under \$500/mo., no lease. 626/792-1168.  
 ROOMMATE for Sierra Madre townhouse; 3 bd., 2.5 ba., nice neighborhood, laundry, garage, yard; rent between \$425-\$550. 626/836-9254.  
 SIMMS, cheap, need 4 ea. at 4 MB x 9 RAM, to expand 486-33 to 32 MB, 70 NS spd., 30 pin tinned. 626/791-0851.  
 SINGERS, alto and tenor, for Pasadena madrigal group. 626/791-3802, Audrey.  
 SPACE INFORMATION & memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.  
 TEXTBOOK TRANSCRIBERS from the printed page to audio cassettes for Recording For the Blind & Dyslexic; people w/backgrounds in the sciences, law, medicine and languages needed; Mon.-Sat., incl. evenings. 800/RFB-TEXT.  
 USER MANUAL for Microsoft Word 5.0 for the Mac; PRINTER, Apple LaserWriter. 626/287-5487.  
 VANPOOL RIDERS, full-time, #20, stops in Northridge and Granada Hills. Ext. 4-0307, Marilyn.  
 VOLLEYBALL players, coed, all levels of play, every Tues. night 8-10 at Eagle Rock High School, \$4/night. 956-1744, Barbara.

## FREE

CAT, male tabby, 3-5 months, seeking warm, friendly home. 626/798-6415.  
 CLEAN FILL DIRT [mostly gravel-like], you haul; several cu yds., take as little or as much as you like; 3 blks. ESE of NY & Hill, Altadena. 798-5152.  
 DOG, beagle-shepherd mix, young, needs gd. home w/gd. fence. 626/798-6415.  
 DOG, male Dalmatian, 1 1/2 yrs., vg health. 626/284-7592.  
 PALLETTS (6), 37" x 37", you pick up. 323/665-3439.  
 PATIO FURNITURE. 626/445-6100.  
 PUPPIES, cocker mix, 7-8 wks. old, rescued/ orphaned, all colors, need gd., loving home. 213/221-1406.  
 PUPPY, Doberman, 10 mos. old, female, spayed, current shots, house-trained, floppy ears, long tail; loves kids, will be a lap dog and sleep on bed with you if you let her; to gd. home. 626/351-0097.

## FOR RENT

ALHAMBRA house, 4 bd., 3 ba., big yard, newly remodeled, \$1,500/obo. 626/576-0805.  
 ALTADENA furnished room, TV, cable and VCR in room, share bathroom, full house privileges including washer & dryer, pets okay, female preferred, \$350 including utilities. 626/798-2112.  
 ARCADIA, cozy, furnished room; includes kitchen privileges, laundry, pool; no smoking, \$350. 626/448-8809, Shary.  
 ARCADIA/MONROVIA area, 2 bd., 1 ba. front house, new paint, tiled bath, newer carpet; stove, washer/dryer possibly available; nice front yd., water/gardener pd.; avail. 10/1; \$725 + \$725 dep. 909/596-9202.  
 HOLLYWOOD KNOLLS area, 1-bd. apt. in 7-unit bldg. (adj. to

Universal Studios, Griffith Park, and Toluca Lake in Burbank); pleasant hillside community w/close fwy access; outside floor entr., newly remodeled, hardwd. oak floors, new refrig., dishwasher, a/c-heat pump, solar-heated water included, laundry rm. downstairs, parking; non-smoker. 626/798-3235.  
 LA CRESCENTA house, 2 bd., 1 ba., above Foothill, no pets, \$1,350. 310/374-0855, Alfonso.  
 MONROVIA, share 2-bd. townhouse, full priv. ba., garage, Indry., full use of kitch./living space, \$400 + 1/2 util., no down. 626/357-0252.  
 MONTEREY HILLS condo, outside S. Pas., bright and airy, priv. end unit on 3rd flr., grt. vw., 2 bd., 1 ba., sep. vanity area, hwd. frs., frpl., cathedral ceil., cent. air/heat, balcony, stove, dshwshr., disposal, cable, some util., pool, Indry. rm. for w/d in unit or use of Indry. facil. on 3rd flr., sec. bldg., 2 sec. prkg. spaces, close to 110 fwy, 10 min./JPL, avail. 10/10, \$900. 213/340-8360.  
 PASADENA townhome-style apt., 3 bd., 3 ba., cent. air/heat, sm. patio; \$1,100/unfurn., \$1,200/furn.; will rent to indiv. students @ \$300-\$400/ea. 626/351-9641.  
 SOUTH PASADENA, furn. studio apt. on 1 level, 1718 Huntington Dr. betw. Milan/Marengo; laundry facilities on premises, parking space; non-smoker; no pets; \$565, utilities pd. 626/792-9053, Marilyn.

## REAL ESTATE

BIG BEAR, new cabin 2 blocks from lake, 2 bd., 2 bath, mud/laundry room, \$129,000. 909/585-9026.  
 GREEN VALLEY, (near Saugas), country property, zoned for horses, 4 lots, surveyed, topo map, buildings plans, well, paved road, view, \$35,000, terms available. 805/526-1052.  
 PALM DESERT, 2 bd., 3 ba., den, sep. din./lv. rms., on golf course at Palm Valley, 12" tile floor w/bordered carpet., marble frplc., corian kitch./ba., mirrored walls, custom built-in wall units, \$310,000 furnished. 760/345-3713.  
 PALM DESERT, exquisite, 2 bd., 2 ba. villa, newly remodeled, w/skylight, patio & 2-car garage; located across Living Desert, great private, secure resort; tennis cts., multiple pools & spas, clubhouse facilities; great locality, around 2 top resorts. 909/620-1364.  
 PASADENA, spacious house, 3 bd. + den, 1-3/4 ba., detached 2-car garage, dead-end street, exc. for small kids; quiet, friendly neighborhood, walking dist. to lib., park & grocery, 10 min./JPL; next to Hastings Ranch; \$185,000/obo. 790-9275.

## VACATION RENTALS

BIG BEAR, 7 mi. from slopes, full kitch./fp, 2 bd., 1 ba., sleeps 6; reasonable rates; 2-night min., no smokers, no pets; exc. hiking, biking, fishing nearby. 909/585-9026, Pat & Mary Ann Carroll.  
 BIG BEAR cabin, quiet area near village, 2 bd., sleeps 8, completely furnished, F/P, TV/VCR, \$75/night. 249-8515.  
 BIG BEAR LAKE cabin, near lake, shops, village, forest trails., 2 bd., sleeps up to 6, fireplace, TV, VCR, phone, microwave, BBQ and more, JPL disc price from \$65/night. 909/599-5225.  
 BIG BEAR LAKEFRONT lux. townhouse, 2 decks, sleeps 6, tennis, pool, spa. 949/786-6548.  
 CAMBRIA, ocean front house, exc. view, sleeps up to 4, \$125/night for 2, \$175/night for 4. 248-8853.  
 ESCONDIDO, Lawrence Welk, lg. 2-bd., 2-ba. condo, slps. 6, avail. Oct. 18-25, golf, tennis, pools, hot tubs, game/workout rms., \$600. 626/836-3931.  
 HAWAII, Maui condo, NW coast, on beach w/ocean vw., 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microwave, dishwasher, pool, priv. lanai, slps. 4, 4/15-12/14 rate: \$95/night/2, 12/15-4/14 rate: \$110/night/2, \$10/night/add'l person. 949/348-8047.  
 LAKE TAHOE, N. shore, 2 bd., 2-1/2 ba. condo, sleeps 6, great loc., all amenities, priv. sandy beach, pool, sauna, walk to golf, fishing 150 yards/front door, 2 miles/casino, JPL special discount rates; 3-nite min. or weekly rates. 626/355-3886, Rosemary or Ed.  
 MAMMOTH condo, 2 bd. + loft, 3 ba., slps 8, spa, pool, full kitchen, TV/VCR, JPL disc rates; walk to Cyn. Lodge. 249-8088.  
 MAMMOTH condo, in Chamonix, 2 bd., 2 ba., slps 6, fireplace, kitchen, microwave, TV, VCR, cable fm stereo, pool & sun area, Jacuzzi, sauna, game, rec., laundry rms., play & BBQ areas., conv. to hiking, shops, lifts, summer events; daily/weekly rates; summer rates to Nov. 249-8524.  
 MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft; sleeps 6-8; fully equipped kitch. incl. microwave, D/W; cable TV, VCR, phone; balcony w/mtn. view; Jacz., sauna; streams, fishponds, close to Mammoth Creek; JPL discount. 626/798-9222 or 626/794-0455.  
 OCEANSIDE, on the sand, charming 1 bd. + condo, panoramic view, walk to pier/marina, pool, spa, game rm. 949/786-6548.  
 PACIFIC GROVE house, 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well-eqpd. kitchen w/microwv, beaut. furn., close to golf, beaches, 17 Mile Dr., Aquarium, Cannery Row, JPL discnt. 626/441-3265.  
 PALM DESERT, exquisite, 2 bd., 2 ba. villa, for vacations or long term, newly remodeled, w/skylight, patio & 2-car garage; located across Living Desert, great private, secure resort; tennis cts., multiple pools & spas, clubhouse facilities; great locality, around 2 top resorts. 909/620-1364.  
 ROSARITO BEACH condo, 2 bd. 2 ba. ocean view, pool, tennis, walk to beach on priv. rd., golf course 6 mi. away, priv. secure prkg. 626/794-3906.  
 SAN CLEMENTE COVE, two 1-bd., 1-ba. condos, ea. slps. 4, avail. Oct. 11-18, 1/2 blk./beach and pier; hot tub, game rm., gas BBQ, \$500/ea. 626/836-3931.  
 S. LAKE TAHOE Keys waterfront home, 4 bd., 3 ba., sleeps 12+, fireplace on 2 levels, decks overlook priv. dock/ski lifts, gourm. kitch., bikes, sail and paddle boats, 3 color TVs, VCR, stereo w/tape/disk, indoor/outdoor pools, hot tub and beach; 8 lighted tennis courts, 10 min./skiing, casinos/hot tub w/wine country; \$995/wk. high season [15 June to 15 Sept; 22 Nov. to 1 March]; \$495/wk. low seas., + \$90 cleaning fee; 3-day min. 626/578-1503, Jim Douglas.